

What is claimed is:

1. A zinc oxide resistor comprising as a basic unit a structure of (a zinc-oxide single crystal/a bismuth-boron based oxide interface layer/a zinc-oxide single crystal) formed of a pair of
5 opposed zinc-oxide single crystals each containing cobalt and manganese dissolved therein in the form of a solid solution, and an oxide which contains a primary component consisting of bismuth and boron and intervenes between said zinc-oxide single crystals, wherein said zinc oxide resistor has non-ohmic properties or exhibits zinc-oxide varistor characteristics, based on said intervening oxide interface layer, and said bismuth-boron based oxide interface layer is formed
10 as a bismuth-and-boron-containing oxide glass phase by the action of said boron contained therein.
2. The zinc oxide resistor as defined in claim 1, wherein each of said opposed zinc-oxide single crystals contains said cobalt dissolved therein in the form of a solid solution, in an amount
15 of 0.5 mol% or more with respect to zinc therein.
3. The zinc oxide resistor as defined in claim 1, wherein each of said opposed zinc-oxide single crystals contains said manganese dissolved therein in the form of a solid solution, in an amount of 0.05 mol% or more with respect to zinc therein.
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4. The zinc oxide resistor as defined in claim 1, wherein:
each of the opposed zinc-oxide single crystals has a length of 5 mm, a width of 5 mm, and a thickness of 0.5 mm;
said oxide containing a primary component consisting of bismuth and boron, to be
25 used for forming a junction between said opposed zinc-oxide single crystals, is a glass prepared in such a manner as to contain, in oxide wt% equivalent, 37.0 to 22.7 wt% of B_2O_3 , 3.8 to 1.9 wt% of Co_2O_3 and 5.7 to 1.6 wt% of MnO_2 , with the remainder being bismuth oxide.
5. The zinc oxide resistor as defined in claim 1, which exhibits an α -value of 20 or more, as a
30 performance index of a zinc oxide varistor.

6. The zinc oxide resistor as defined in claim 1, wherein said (zinc-oxide single crystal/bismuth-boron based oxide interface layer/zinc-oxide single crystal) structure serving as said basic unit has an operating voltage of 2.9 ± 0.3 V, as a performance index of a zinc oxide varistor.

7. The zinc oxide resistor as defined in claim 1, wherein said (zinc-oxide single crystal/bismuth-boron based oxide interface layer/zinc-oxide single crystal) structure is provided in a number of n,

wherein said structures of the number n are repeatedly superimposed in a layered manner, and provided with a zinc-oxide single crystal superimposed thereon to form a (n + 1) layered structure including the number (n + 1) of zinc-oxide single crystals and the number n of bismuth-boron based oxide interface layers,

wherein said zinc-oxide resistor has an operating voltage of $(2.9 \pm 0.3) n$ V, as a performance index of a zinc oxide varistor.

8. The zinc oxide resistor as defined in claim 1, wherein said (zinc-oxide single crystal/bismuth-boron based oxide interface layer/zinc-oxide single crystal) structure is adjusted to have an operating voltage of x V, as a performance index of a zinc oxide varistor, and provided in a number of n, wherein said structures of number n are electrically connected in series, wherein said zinc-oxide resistor has an operation voltage of $n \times x$ V, as a performance index of a zinc oxide varistor.

9. A method of producing the zinc oxide resistor as defined in claim 1, comprising:

disposing an oxide containing bismuth and boron, between a pair of opposed zinc-oxide single crystals to form a sandwich structure of (a zinc-oxide single crystal/a composition to be formed as a glass phase/a zinc-oxide single crystal);

heating and holding said sandwich structure at a high temperature allowing said oxide containing bismuth and boron, to be molten; and

rapidly cooling said heated sandwich structure to join said pair of zinc-oxide single

crystals with a glass-phase oxide interface layer intervening therebetween.

10. The method as defined in claim 9, includes:

bringing each of two zinc-oxide single crystals into contact with a chunk of oxide
5 cobalt, and heating said zinc-oxide single crystals and said chunk of oxide cobalt at a high
temperature capable of inducing a diffusion reaction to diffuse cobalt from said chunk of oxide
cobalt into said zinc-oxide single crystals so as to prepare each of said opposed zinc-oxide single
crystals in such a manner as to have a cobalt concentration of 0.5 mol% or more.

10 11. The method as defined in claim 9, wherein:

each of the opposed zinc-oxide single crystals has a length of 5 mm, a width of 5 mm,
and a thickness of 0.5 mm;

said oxide containing a primary component consisting of bismuth and boron, to be
used for forming a junction between said opposed zinc-oxide single crystals, is a glass prepared
15 in such a manner as to contain, in oxide wt% equivalent, 37.0 to 22.7 wt% of B₂O₃, 3.8 to 1.9
wt% of Co₂O₃ and 5.7 to 1.6 wt% of MnO₂, with the remainder being bismuth oxide.

12. The method as defined in claim 9, wherein said oxide containing a primary component
consisting of bismuth and boron, to be used for forming a junction between said opposed
20 zinc-oxide single crystals, is a glass, wherein said method includes:

flattening each surface of said opposed zinc-oxide single crystals through mirror
polishing; and

adjusting a quantity of said glass in such a manner that a molar ratio of said glass
quantity in an equivalent bismuth quantity contained in said glass to a quantity of said opposed
25 zinc-oxide single crystals, is set at 1.2 mol%.